BEFORE THE
PUBLIC SERVICE COMMISSION OF
SOUTH CAROLINA

DOCKET NO. 2021-1-E

In the Matter of Annual Review of Base Rates for Decrease in Residential and Lighting Customer Fuel Costs and for Increase in General Service Non-Demand and General Service Demand Customer Fuel Costs for Duke Energy Progress, LLC	))))))	**DIRECT TESTIMONY OF** **BEN WALDREP FOR** **DUKE ENERGY PROGRESS, LLC**

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Ben Waldrep and my business address is 526 South Church Street, Charlotte, North Carolina.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am Senior Vice President of Nuclear Operations for Duke Energy Corporation ("Duke Energy") with direct executive accountability for Duke Energy's North Carolina nuclear stations, including Duke Energy Progress, LLC's ("DEP" or the "Company") Brunswick Nuclear Station ("Brunswick") in Brunswick County, North Carolina, the Harris Nuclear Station ("Harris") in Wake County, North Carolina, and Duke Energy Carolinas, LLC's McGuire Nuclear Station, located in Mecklenburg County, North Carolina.

Q. WHAT ARE YOUR RESPONSIBILITIES AS SENIOR VICE PRESIDENT OF NUCLEAR OPERATIONS?

A. As Senior Vice President of Nuclear Operations, I am responsible for providing oversight for the safe and reliable operation of Duke Energy's nuclear stations in North Carolina. I am also involved in the operations of Duke Energy's other nuclear stations, including DEP's Robinson Nuclear Station ("Robinson") located in Darlington County, South Carolina.

Q. PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I have a bachelor's degree in Nuclear Engineering from Georgia Institute of Technology, a Master's in Business Administration from the University of Phoenix, and I earned a CERT Certificate in Cybersecurity Oversight from Carnegie Mellon University. I have over 30 years of experience in the nuclear industry, beginning my career at Florida Power & Light's Turkey Point Nuclear Station where I earned a senior reactor operator certification. In 1999, I joined

Progress Energy where I held multiple positions of increasing responsibility and served as site vice president at both the Harris and Brunswick nuclear plants. Following the merger of Duke Energy and Progress Energy in 2012, I served as the vice president of corporate governance and operations support for Duke Energy's nuclear fleet, and later was promoted to senior vice president and chief security officer for the enterprise. In the chief security officer role, I was responsible for maintaining Duke Energy's physical and cyber security. In December 2020, I assumed my current role of senior vice president nuclear operations.

Q. HAVE YOU TESTIFIED BEFORE THIS COMMISSION IN ANY PRIOR PROCEEDINGS?

A. No.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to describe and discuss the performance of the Brunswick, Harris, and Robinson nuclear plants for the period of March 1, 2020 through February 28, 2021 (the "review period").

Q. YOUR TESTIMONY INCLUDES THREE EXHIBITS. WERE THESE EXHIBITS PREPARED BY YOU OR AT YOUR DIRECTION AND UNDER YOUR SUPERVISION?

A. Yes. These exhibits were prepared at my direction and under my supervision.

Q. PLEASE PROVIDE A DESCRIPTION OF THE EXHIBITS.

A. The exhibits and descriptions are as follows:

Waldrep Exhibit 1 - Calculation of the nuclear capacity factor for the review period pursuant to S.C. Code § 58-27-865

Waldrep Exhibit 2 - Nuclear outage data for the review period

Waldrep Exhibit 3 - Nuclear outage data through the billing period [1]

Q. PLEASE DESCRIBE DEP'S NUCLEAR GENERATION PORTFOLIO.

A. The Company's nuclear generation portfolio consists of approximately 3,593[2] megawatts ("MWs") of generating capacity, made up as follows:

Brunswick - 1,870 MWs

Harris - 964 MWs

Robinson - 759 MWs

Q. PLEASE PROVIDE A GENERAL DESCRIPTION OF DEP'S NUCLEAR GENERATION ASSETS.

A. The Company's nuclear fleet consists of three generating stations and a total of four units. Brunswick is a boiling water reactor facility with two units and was the first nuclear plant built in North Carolina. Unit 2 began commercial operation in 1975, followed by Unit 1 in 1977. The operating licenses for Brunswick were renewed in 2006 by the NRC, extending operations up to 2036 and 2034 for Units 1 and 2, respectively. Harris is a single unit pressurized water reactor that began commercial operation in 1987. The NRC issued a renewed license for Harris in 2008, extending operation up to 2046. Robinson is also a single unit pressurized water reactor that began commercial operation in 1971. The license renewal for Robinson Unit 2 was issued by the NRC in 2004, extending operation up to 2030.

Q. WERE THERE ANY CAPACITY CHANGES WITHIN DEP'S NUCLEAR PORTFOLIO DURING THE REVIEW PERIOD?

A. No.

[1] This data is provided in confidential and publicly redacted versions for security purposes.
[2] As of January 1, 2021.

Q. WHAT ARE DEP'S OBJECTIVES IN THE OPERATION OF ITS NUCLEAR GENERATION ASSETS?

A. The primary objective of DEP's nuclear generation department is to safely provide reliable and cost-effective electricity to DEP's Carolinas customers. The Company achieves this objective by focusing on a number of key areas. Operations personnel and other station employees are well-trained and execute their responsibilities to the highest standards in accordance with detailed procedures. The Company maintains station equipment and systems reliably, and ensures timely implementation of work plans and projects that enhance the performance of systems, equipment, and personnel. Station refueling and maintenance outages are conducted through the execution of well-planned, well-executed, and high-quality work activities, which effectively ready the plant for operation until the next planned outage.

Q. PLEASE DISCUSS THE PERFORMANCE OF DEP'S NUCLEAR FLEET DURING THE REVIEW PERIOD.

A. The Company operated its nuclear stations in a reasonable and prudent manner during the review period, providing approximately 49.5% of the total power generated by DEP. The four nuclear units operated at an actual system average capacity factor of 93.13% during the review period.

As shown on Waldrep Exhibit 1, DEP achieved a net nuclear capacity factor, excluding reasonable outage time, of 101.56% for the review period. This capacity factor is above the 92.5% set forth in S.C. Code § 58-27-865(F), which states in pertinent part:

> There shall be a rebuttable presumption that an electrical utility made every reasonable effort to minimize cost associated with the operation of its nuclear generation facility or system, as applicable, if the utility achieved a net capacity factor of ninety-two and one-half percent or higher during the period under review. The calculation of the net capacity factor shall exclude reasonable outage time associated with reasonable refueling, reasonable

> maintenance, reasonable repair, and reasonable equipment replacement outages; the reasonable reduced power generation experienced by nuclear units as they approach a refueling outage; the reasonable reduced power generation experienced by nuclear units associated with bringing a unit back to full power after an outage....

The performance results discussed above support DEP's continued commitment for achieving high performance without compromising safety and reliability.

Q. WHAT IMPACTS A UNIT'S AVAILABILITY AND WHAT IS DEP'S PHILOSOPHY FOR SCHEDULING REFUELING AND MAINTENANCE OUTAGES?

A. In general, refueling requirements, maintenance requirements, and NRC operating requirements impact the availability of DEP's nuclear system. Prior to a planned outage, DEP develops a detailed schedule for the outage and for major tasks to be performed including sub-schedules for particular activities.

The Company's scheduling philosophy is to plan for a best possible outcome for each outage activity within the outage plan. For example, if the "best ever" time a particular outage task was performed is 10 days, then 10 days or less becomes the goal for that task in each subsequent outage. Those individual goals are incorporated into an overall outage schedule. The Company aggressively works to meet, and measures itself against, that schedule. Further, to minimize potential impacts to outage schedules, "discovery activities" (walk-downs, inspections, etc.) are scheduled at the earliest opportunities so that any maintenance or repairs identified through those activities can be promptly incorporated into the outage plan. Those discovery activities also have pre-planned contingency actions to ensure that, when incorporated into the schedule, the activities required for appropriate repair can be performed as efficiently as possible.

As noted, the Company uses the schedule for measuring outage planning and execution and driving continuous improvement efforts. However, in order to provide reasonable, rather than best ever, total outage time for planning purposes, particularly with the dispatch and system operating center functions, DEP also develops an allocation of outage time which incorporates reasonable schedule losses. The development of each outage allocation is dependent on maintenance and repair activities included in the outage, as well as major projects to be implemented during the outage. Both schedule and allocation are set aggressively to drive continuous improvement in outage planning and execution.

Q. HOW DOES DEP HANDLE OUTAGE EXTENSIONS AND FORCED OUTAGES?

A. When an outage extension becomes necessary, DEP believes that work completed in the extension results in longer continuous run times and fewer forced outages, thereby reducing fuel costs in the long run. Therefore, if an unanticipated issue that has the potential to become an on-line reliability issue is discovered while a unit is off-line for a scheduled outage and repair cannot be completed within the planned work window, the outage is usually extended to perform necessary maintenance or repairs prior to returning the unit to service. In the event that a unit is forced off-line, every effort is made to safely perform the repair and return the unit to service as quickly as possible.

Q. DOES DEP PERFORM POST-OUTAGE CRITIQUES AND CAUSE ANALYSES FOR INTERNAL IMPROVEMENT EFFORTS?

A. Yes. The nuclear industry recognizes that constant focus on operational excellence results in improved nuclear safety and reliability. As such, DEP applies self-critical analysis to each outage to identify every potential cause of an outage delay or event resulting in a forced or

extended outage. These critiques and cause analyses do not document the broader context of the outage or event, and thus rarely reflect strengths and successes.

Q. WHAT IS THE RELATIONSHIP BETWEEN THE STANDARDS THAT THE COMPANY APPLIES IN ITS POST OUTAGE CRITIQUES AND THE "EVERY REASONABLE EFFORT" STANDARD OF SECTION 58-27-865?

A. In the Company's outage evaluations, we are striving to identify any opportunity for improvement. We are not assessing the "reasonableness" of any conduct or actions that might have contributed to the outage. Reasonableness focuses on what was done in light of what was known prior to the event; in our outage evaluations we are focused on learning and applying new lessons from our experiences in order to improve our operations. The fact that an outage investigation may indicate ways we can improve our future operations does not indicate that we have determined that our previous practices did not meet the reasonableness standard.

Q. WHAT REFUELING OUTAGES WERE REQUIRED AT DEP'S NUCLEAR FACILITIES DURING THE REVIEW PERIOD?

A. The Company completed two refueling outages during the review period, Brunswick Unit 1 and Robinson.

Brunswick Unit 1 shut down for scheduled refueling on February 29, 2020. In addition to refueling, safety and reliability enhancements were completed during the outage. Significant maintenance activities completed included replacement of drywell fan motors and chemical cleaning of the drywell cooler, and replacement of four cryogenic tube fittings. During the outage, four 125 Vdc safety-related batteries were replaced and new moisture separator reheater drain tank level control systems were installed. Significant testing and

inspections completed during the outage included 10-year main generator and exciter and high-pressure coolant injection system overhaul inspections. Addressing long-standing reliability challenges, final testing of an upgraded refueling bridge and hoists was completed. This upgraded equipment was used during refueling activities in the outage. After refueling, maintenance, and testing and inspections completed, the unit returned to service on March 28, 2020. The outage was completed with no injuries, O&M expenditures below budget, and established a new record low radiation exposure for Brunswick refueling outages. The outage extended 3 days beyond the scheduled allocation primarily due to emergent challenges with the 'F' safety relief pilot valve. As the unit was heating up and preparing to exit the refueling outage, the pilot valve failed to seat during testing. Repair of the pilot valve required the reactor to be shut down.

Robinson was disconnected from the grid for refueling on November 7, 2020. Maintenance activities, safety and reliability enhancements, and testing and inspections were completed as the unit was refueled. Large pump and motor maintenance included the replacement of the B heater drain and B condensate pumps. Both the heater drain and condensate pump motors were refurbished, and the B main feed pump was overhauled. Cleaning, plug replacement and testing was completed on the A condenser water box, and the A component cooling water heat exchanger was cleaned and inspected. Electrical A train maintenance included governor replacement on the A emergency diesel generator, installation of a permanent temporary power panel within containment which will reduce time and resources for future outages, and 115KV and 230KV switchyard construction changes supporting more flexibility in scheduling some work online versus during outage periods. Testing and inspection activities included steam generator Eddy Current testing, containment

vessel liner panel inspections, and containment integrated leak rate (ILRT) and structural integrity tests. The containment structural integrity tests and ILRT support license renewal. After refueling, maintenance, and testing and inspections completed, the unit returned to service on December 9, 2020. The outage was completed within budget and with the lowest refueling outage dose for the station. The outage extended 15 hours beyond the allocation, primarily driven by emergent challenges with containment sump level and rod control malfunctions.

Q. OTHER THAN REFUELING, WHAT OUTAGES OCCURRED AT DEP'S NUCLEAR FACILITIES DURING THE REVIEW PERIOD?

A. In April 2020, indications of failed fuel were observed on Brunswick Unit 1. A mid-cycle planned maintenance outage was scheduled to identify and remove the failed fuel. Brunswick Unit 1 entered the maintenance outage on June 13, 2020. During the outage, one failed bundle was identified and replaced, and the unit returned to service on June 23, 2020. The duration of the planned outage was 10 days. The root cause of the fuel failure is in progress. Once completed, the Company will share the results of the root cause investigation with the Office of Regulatory Staff. Brunswick Unit 1 was taken offline for 18 days in August 2020 due to a ground on the main generator. While the unit could remain in service with one ground on the generator, any additional ground would have posed unacceptable risk of significant damage to the generator. As Hurricane Isaias was approaching and significant wind-driven rain was anticipated, the Company removed the generator from the grid to identify and repair the source of the ground. The duration of the forced outage was driven by the complex work required to disassemble and reassemble the generator. The unit returned to service on August 22, 2020.

Brunswick Unit 2 was taken offline briefly on September 19, 2020 and again on October 9, 2020 to address failing no load disconnect switch phases. Both the September and October forced outages were less than 24 hours in duration. During the recently completed Brunswick Unit 2 spring 2021 refueling outage, the unit's no load disconnect switch was replaced with a circuit breaker. This circuit breaker increases the operational margin, and I am confident this will successfully resolve the reliability challenges the switch posed. The no load disconnect switch on Brunswick Unit 1 is scheduled to be replaced with a circuit breaker during the unit's spring 2022 refueling outage.

During maintenance activities in March 2020, Harris was forced offline for 2 days due to a loss of hydraulic control header pressure. Investigation determined that while plant personnel appropriately followed all applicable procedures, a procedure was flawed based on erroneous information provided by a vendor. The procedure flaw resulted in the pressure loss and resulting forced outage. In August 2020, Harris was taken offline for 2.5 days when a control rod dropped during testing. Additionally, a generator lockout resulted from a non-segregated bus failure in December 2020 resulting in a 6-day forced outage.

Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes, it does.

DUKE ENERGY PROGESS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR CAPACITY FACTOR PURSUANT TO S.C. CODE ANN. § 58-27-865(F)
REVIEW PERIOD OF MARCH 2020 THROUGH FEBRUARY 2021

1	Nuclear System Actual Net Generation During Review Period	29,313,935	MWH
2	Total Number of Hours during Review Period	8,760	
3	Nuclear System MDC during Review Period	3,593.00	MW
4	Reasonable Nuclear System Reductions	2,610,393	MWH
5	Nuclear System Capacity Factor = L1/((L2a*L3a)-L4)	101.56	%

DUKE ENERGY PROGESS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR OUTAGE DATA FOR REVIEW PERIOD OF
MARCH 2020 THROUGH FEBRUARY 2021

Nuclear outages lasting one week or more during the Review Period

Station/Unit	Date of Outage	Explanation of Outage
Brunswick 1	2/29/2020 - 3/28/2020	Scheduled refueling (B1R23)
Brunswick 1	6/13/2020 - 6/23/2020	Planned maintenance outage to replace defective fuel (B1M23A)
Brunswick 1	8/3/2020 - 8/22/2020	Forced outage due to ground on the main generator rotor
Robinson	11/7/2020 - 12/9/2020	Scheduled refueling (R2R32)

DUKE ENERGY PROGESS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR OUTAGE SCHEDULE THROUGH BILLING PERIOD
MARCH 2021 THROUGH JUNE 2022

Scheduled nuclear outages lasting one week or more through the Billing Period

Station/Unit	Date of Outage[1]	Explanation of Outage

REDACTED

[1] This exhibit represents DEP's current plan, which is subject to change based on fluctuations in operational and maintenance requirements.